

SUPPLEMENT.

The Mining Journal, RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

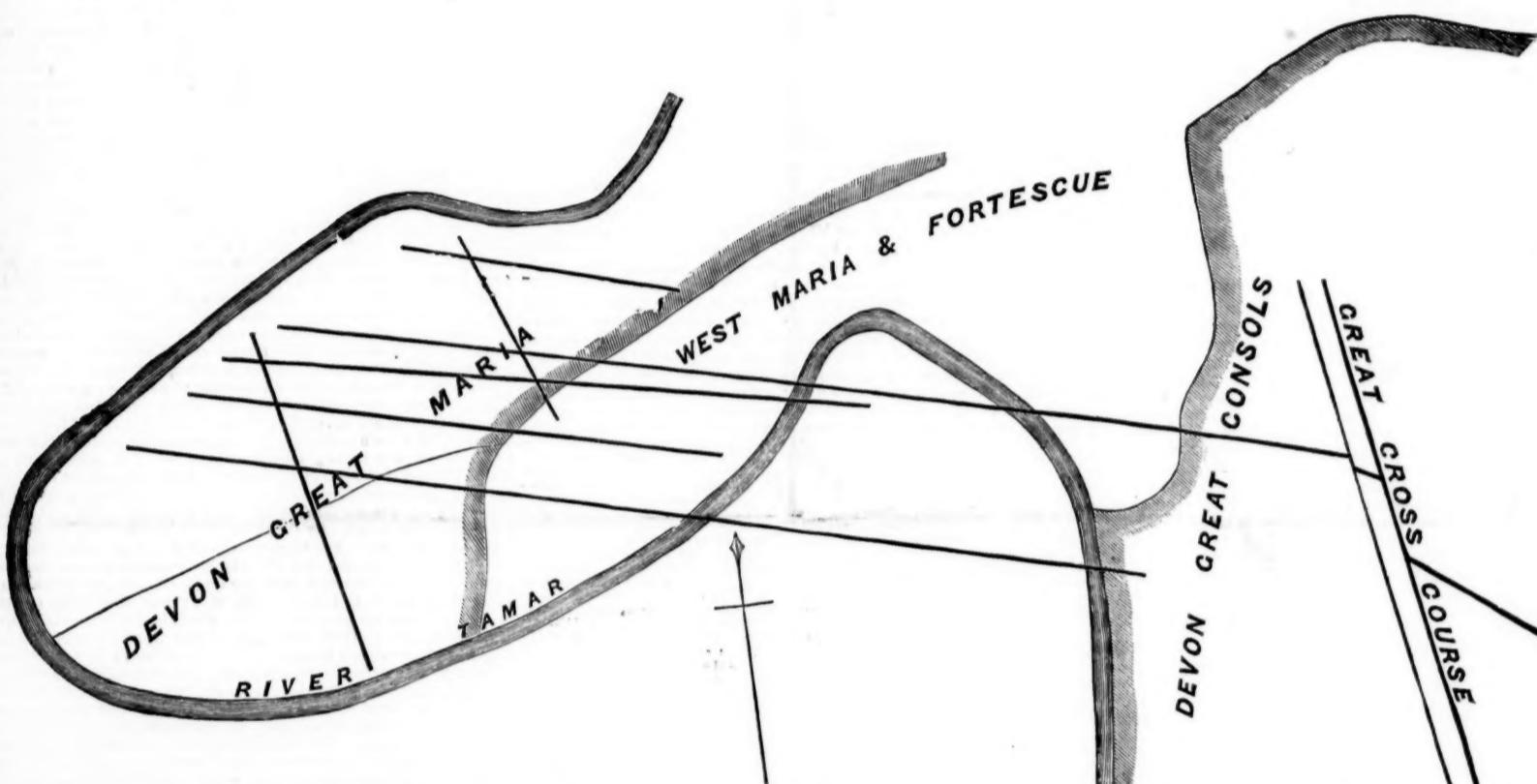
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LONDON, SATURDAY, SEPTEMBER 10, 1864.

STAMPED.... SIXPENCE.
UNSTAMPED. FIVEPENCE.

ROUGH PLAN OF THE DEVON GREAT MARIA MINE,

SHEWING THE CONTINUATION OF THE DEVON GREAT CONSOLS MINES.



The above is a plan of the Devon Great Wheal Maria sett, showing its position with reference to the Devon Great Consols; the east and west lines show the direction of the lodes continuing from the Devon Great Consols into the ground of the Devon Great Maria. These have been

carefully laid down by the mineral surveyor of the Devon Great Consols, and truthfully convey the impression as to the lodes and formation of the strata of the neighbourhood. This mine has been reported upon by all the leading agents of the neighbourhood, all of whom agree as to its great

intrinsic worth. The geological condition of the two properties is identical, and it is the general opinion of all the mining authorities of the country that great results may be reasonably expected by working this mine; the majority of shares are subscribed for, and we are informed the list closes on Friday next.

THE METALLURGICAL PROCESSES OF THE MANSFIELD COPPER WORKS.

[AN ABSTRACT OF PAPERS BY ALBRECHT VON GRODDECK.]

The ordinary Mansfeld ores, or "work," contain copper, silver, and nickel in sufficient quantities to be treated remuneratively; besides the ordinary "work," certain nickeliferous ores (copper nickel) are raised. The objects of the metallurgical processes are the separating and obtaining of the metals—firstly, from the ordinary ores; and, secondly, from the nickeliferous ores, which have to undergo a special treatment.

The object of the first process is the production from the low-product ores described of a regulus, called concentration regulus, which contains from 65 to 69 per cent. of copper, and is ready for desilverisation. As in this process about 90 per cent. of the weight of the ores has to be slagged off, it is evident that they cannot profitably bear any lengthened carriage before smelting, which necessitates and justifies the fact that they are treated at works near the mines, but far apart from each other. The concentration regulus produced by this raw smelting process at these various works can, on the other hand, be most profitably treated in the two stages of the second process—that of desilverisation, and that of getting and refining the metallic copper—at some one establishment for each distinct process; since the obvious advantage of concentrating such operations more than compensates for the extra cost of carriage on a highly enriched product. The desilverisation, consequently, is effected entirely at the Gotthelohengshütte, where the desilverised residues are also smelted for black copper; and this black copper is refined either by the ordinary method in a reverberatory furnace, or in the small hearth at the Saigerhütte, about half-a-mile off. In the third and final process the refinery residues are treated until they contain about 20 per cent. of nickel, from which black (nickel) vitriol is manufactured. This series of processes has remained without change since 1831, when the old refining (Saiger) method was abandoned, and the desilverisation of the copper regulus introduced.

For the purpose of concentrating the metallic contents of the Mansfeld ores, the dry method has had to be adopted, as the high percentage of lime they contain precludes the adoption of any wet process, on account of the great consumption of acids that would be necessary under any present conditions of metallurgical knowledge. The dry method is also recommended by the fact that the slag-producing constituents are found in the ores nearly in the proportions required for smelting. It has been found from experience, the particulars of which will be referred to more fully further on, that these ores cannot be smelted in reverberatory furnaces; so they are always treated in blast-furnaces, from which ore-furnace regulus is obtained. The use of the blast-furnace, however, necessitates the previous removal of the bituminous constituents of the ores, which is done in the first part of the process.

The shist is roasted by burning it in heaps in the open air, after which the roasted ore is fused in a kind of blast-furnace, from 13 feet to 20 feet high, called a brillenofen, with the addition of fluor-spar and concentra-

tion slag. The principal products of this stage of the process are—slags, containing about 0.85 per cent. of copper, which mostly go to the waste heaps, and ore-furnace regulus (rohstein), containing from 22 to 33 per cent. of copper, which is ready for treatment at the third stage of the process. As the ore-furnace regulus obtained in the last stage cannot with advantage be subjected to the process of desilverisation, it is put through another process of concentration. To effect this it has to be first roasted, which was formerly done in open heaps, or in sheds, but is at present carried out in kilns, in order that the sulphurous acid may be utilised in the manufacture of sulphuric acid. The gain in thus collecting the sulphurous acid is not so much in the value of the sulphuric acid made from it as in the fact that by this means the sulphurous acid gas, so deleterious to vegetation, is prevented from escaping.

This roasted regulus used formerly to be concentrated like the roasted schist by fusion in a blast-furnace. In the use of this kind of furnace the occasional accidental formation of black copper is well known to be unavoidable, but under the old refining (Saiger) method this was not found seriously to interfere with the working. Since, however, this Saiger method was replaced, in 1831, by the new desilverising processes—in which the black copper cannot be desilverised in the regular course of working—this accidental formation of black copper became very troublesome. This was the principal reason which led to the substitution of the reverberatory furnace in this stage of the process—as with this furnace an accidental formation of black copper can with ease be entirely avoided. But besides this there were other important reasons in favour of the alteration:—1. The cheap Riestädt lignite could be employed in the reverberatory furnace.—2. The quantities smelted could be increased, inasmuch as the water-power formerly required for blowing the blast-furnaces at this stage became available for working additional furnaces at the second stage (fusion of the roasted ore); and—3. The reverberatory furnace allowed of "trials" being from time to time taken, from which the exact nature of the concentration regulus could be ascertained, and, consequently, regulated to the proportions of copper and sulphur most suitable for the preliminary roasting stage of the subsequent desilverising process, which could not be so accurately regulated in a blast-furnace. The principal objection to the use of the reverberatory furnace, which is that the resulting slags are very rich in copper (they contain 8 per cent.), has no force whatever with the Mansfeld processes, in which such slags can be advantageously worked up in the raw smelting.

For these reasons the ore-furnace regulus is now exclusively concentrated in reverberatory furnaces, with the addition of quartz sand, poor sand ores, or ore-furnace slag. The product of this last stage of the process of raw smelting is the concentration regulus, containing from 65 to 69 per cent. of copper.

Since 1831 the silver has been extracted from the regulus instead of from the metal (black copper), as was the case up to that time. In that year the old Saiger was replaced by the amalgamation method, but this was soon abandoned for Augustin's process, which, in turn, is now super-

seeded by Zier vogel's method of extracting the silver. In all of these three processes the concentration regulus, which consists essentially of sulphides of iron, copper, and silver, has to be roasted until these sulphides are converted into sulphates. A perfectly satisfactory conversion of the sulphides into these salts can, however, only be effected where the concentration regulus contains the proper proportion of sulphur—neither too much nor too little. For the copper percentage stated the regulus contains, as a matter of fact, the necessary proportion of sulphur required for roasting; but still it has to be finely pulverised, and requires to be very carefully treated. To effect this pulverisation it is tapped into water directly from the reverberatory furnace, and after being thus granulated it can be easily ground to fine powder in mills, which powder is afterwards well roasted in a double-bedded reverberatory furnace. This roasted powder—which consists of the sulphates of iron, copper, and silver—is now, in all three methods, decomposed at a very high temperature, resulting in the formation of sesquioxide of iron, oxide of copper, and sulphate of silver, the completeness of the conversion being ascertained by trying samples.

In both the old methods, at this stage the sulphate of silver was converted by the admixture of common salt into chloride of silver. In the amalgamation process this chloride of silver was precipitated by metallic iron, and the silver extracted from the precipitate by mercury, from which it was finally separated by distillation. In Augustin's process the chloride of silver was dissolved in a solution of common salt, and the silver precipitated by copper, from which it is obvious how much superior, both in regard to the time and materials consumed in the operation, this method must have been to the amalgamation process. A further comparison, however, will show how much superior to both of these old methods is that of Zier vogel's, at present in use, in which the sulphate of silver is dissolved in acidulated water, and the silver precipitated from this solution by copper. But an essential condition of Zier vogel's process is that the regulus shall contain little or no arsenic or antimony, for otherwise during the roasting, besides sulphate of silver, arsenical, and antimonial silver-salts (which are insoluble in water) would be formed. This condition obtains in the case of the Mansfeld concentration regulus, in contrast with most other copper regulus, especially that of the Upper and Lower Harz.

The silver precipitate is first washed, to get rid of any particles of copper or salts that may be adhering, and is then refined. Under the present system of working, the desilverised residues—consisting essentially of protoxide of iron, sesquioxide of iron, and oxide of copper—are never found to contain more than $\frac{1}{2}$ oz. of silver per centner (0.027 per cent. silver). The desilverised regulus is now converted into black copper by simply smelting in a blast-furnace. As, however, it is in a pulverulent form it has to be previously kneaded into balls, with about 8 per cent. of clay, and some finely-powdered roasted thin regulus. After being dried, these balls are smelted in a blast-furnace (18 $\frac{1}{2}$ ft. high, and of the kind already mentioned as a brillenofen), with the addition of unroasted thin regulus. This smelting produces both poor and rich slags—the former going to the waste heaps, and the latter being subsequently re-smelted. Of the pro-

ducts obtained in this smelting—black copper and thin regulus—the latter is invariably again mixed with the charge, while the former is conveyed to the Saigerhütte to be refined in the small hearth, or by the ordinary process in reverberatory furnaces.

The refining of the black copper of the Mansfeld district continues still to be generally carried out in the small hearth, in which, owing to the purity of the black copper, a peculiar metal (in characteristic thin discs) is obtained, forming the "rosette copper" of commerce, for which there is such a large demand on the Continent. By refining in the reverberatory furnace malleable copper of an equally peculiar excellence is obtained at a smaller cost than with the small hearth. As the Mansfeld works extend their operations this method is coming into increased use; at present, however, the two reverberatory refining furnaces at the Saigerhütte are only occasionally in operation, from a deficiency in the supply of copper.

The residues from the refining (in the small hearth, or by the ordinary process) are smelted in a sunfopen, with the addition of ore-furnace slag and fluor-spar. The resulting products are refinery slag No. 1 and poor slag. The latter is cast into blocks for building purposes, and the former, in consequence of its impurities, has to be again smelted in a small hearth before refining, after which it becomes refinery slag No. 2. It is intended to carry out this operation in a refining furnace (spleissofen), with coal as a fuel, but this arrangement has not yet been brought into operation. This smelted refinery slag No. 2 is next refined, and the resulting residues again smelted, which, after refining like No. 1, become refinery slag No. 3, which is the final product treated for obtaining black (nickel) vitriol. It is granulated in water, in order to facilitate its ultimate solution.

This granulated refinery slag, which consists essentially of copper, nickel, and lead, is dissolved in sulphuric acid, the lead remaining behind as lead slimes. On the first evaporation the solution only yields copper-vitriol, but ultimately, by various crystallisations, black (nickel) vitriol of various qualities is obtained. Endeavours are now being made to obtain metallic nickel for German silver from this nickel-vitriol, but as yet without success as far as obtaining a metal free from sulphur.

At the Sangerhäuserhütte copper-nickel is smelted to nickel-speise in a low blast-furnace (krummofen), with charcoal for a fuel. The speise made is at present sold, since the actual production is too trifling to make it worth while to subject it to a further treatment, and the continuance of mining operations in the Sangerhausen district (which produces the nickeliferous ores) is under consideration.

On comparing the Mansfeld processes for extracting copper and silver with those pursued in the Upper and Lower Harz districts, it is obvious that the variations in the metallurgical methods arise from the different nature of the ores to be treated, and are not due to mere local usage. The most important distinction between the ores of these districts is the great variation in the relative proportions of arsenic, antimony, and silicic acid they contain in respect of the earthy constituents. While the ores of the Upper Harz district can be "dressed," such is not the case either in the Lower Harz or the Mansfeld districts, in consequence of the large intermixtures of other sulphides in proportion to the earthy matters. Still, however, the copper pyrites ore of the Upper Harz is so far similar to that of the Lower Harz that in both sulphides predominate; while the case is quite different with the Mansfeld ores, of which earths (silica and lime) are the characteristic constituents.

THE INDUSTRIAL RESOURCES OF THE TYNE, WEAR, AND TEES.

As the time of another annual meeting of the British Association for the Advancement of Science is approaching, the issue of the second edition of the very interesting volume containing an account of the industrial resources of the Tyne, Wear, and Tees* appears to be very opportune. The exertions of the people of Newcastle rendered the labours of the Association for 1863 of the greatest possible general utility, and it is much to be hoped that in all towns which may hereafter be honoured with a visit from it will prove themselves equally desirous of diffusing the advantages which the efforts of the Association offer. In noticing the issue of the first edition we remarked that the volume very appropriately opened with Sir William Armstrong's address to the British Association, which forms the introduction to the several reports, which comprise that on Coal, Coke, and Coal Mining, by Messrs. Nicholas Wood, J. Taylor, and J. Marley; those on the Metallurgy of the District (including Iron), by Mr. I. L. Bell; Steel, by Mr. T. Spencer; Lead and Silver, Copper, Zinc, and Antimony, by Dr. Richardson and Mr. Thomas Sopwith; and Aluminium by Mr. J. L. Bell; that on the Chemical Manufactures of the District, by Dr. Richardson and Messrs. Stevenson and Clapham; the report on the Vitreous and Ceramic Manufactures of the District (including Glass, by Mr. R. W. Swinburne; Earthenware, by Mr. T. C. Maling; and Fire-clay Wares, by Mr. J. Cowen); that on the Manufacture of Paper, by Mr. W. H. Richardson; that on the Tanning Trade of Newcastle and Gateshead, by the late T. C. Angus; that on the Construction of Iron Ships, and the Progress of Iron Shipbuilding on the Tyne, the Wear, and the Tees, by Mr. C. M. Palmer; the report on the Engineering Manufactures of the District, by Messrs. Westmacott and Spencer; that on the Railways and Locomotives of the Districts adjoining the Rivers Tyne, Wear and Tees; and that on the Improvements introduced into the Rivers of the District, which is subdivided into the Tyne by Mr. Ure, and the Tees by Mr. Fowler. The second edition contains, in addition, reports on the Manufacture of Carpets, by Mr. W. Henderson; on the Manufacture of Hats, by Mr. W. Wilson; on the Manufacture of Rope, by Mr. G. Luckley; and on the Improvements of the River Wear, by Mr. T. Meik.

An abstract of the shipping registry returns of Mr. Luckley are also given, and from them it appears that the value of the shipping owned on the three rivers amounts to the extraordinary sum of 5,099,000L. The information relative to the annual value of the mining and manufactured products of the district has been corrected, and rendered more nearly complete. The revised figures show—Coals, 6,650,471L; metallurgical products, 3,707,941L; chemical manufactures, 1,583,220L; textile manufactures, 972,400L; leather, 135,659L; glass and clay wares, 1,066,650L; iron and timber shipbuilding, 2,275,828L; and engines and machinery, 1,928,000L. With regard to the work generally we can only repeat what we stated with reference to the first edition, that the work is beautifully illustrated with engravings, executed in the best possible manner, and chromo-lithographic maps, plans, and sections, produced in that admirable style for which Newcastle-on-Tyne has so long been celebrated. The volume is of especial value to all interested in the locality, and is well worthy of perusal by commercial men generally, from the enormous amount of interesting matter it contains, and it is one which will at the same time be an ornament to any library in which it may find a place.

* "The Industrial Resources of the Three Northern Rivers, the Tyne, Wear, and Tees, including the Reports on the Local Manufactures, read before the British Association in 1863." Edited by Sir W. Armstrong, Messrs. I. Lowthian Bell and John Taylor, and Dr. Richardson. London: Longman and Co. Newcastle-on-Tyne: Andrew Reid.

CHEMISTRY IN THE MANUFACTORY.

So large a portion of the improvements made in connection with industrial progress during the past half-century has been based upon chemical discoveries, that it is by no means unusual to find processes involving the most important principles of chemical science, conducted, as it were, automatically in our manufactories by almost unskilled workmen; but although this circumstance is acknowledged, it cannot be denied that it is the intimate acquaintance with the principles upon which each process is dependent, and the ability to comprehend with facility the probable effect of modifications which may suggest themselves whilst such process is going on, that gives one manufacturer an advantage over another, and fits the intelligent workmen for the more honourable position in the workshop. We have before us a Dictionary of Industrial Chemistry—a very valuable work, in four volumes (besides the introduction, which alone occupies one volume), by Messrs. Barreswil and Aimé Girard,* assisted by such men as Liebig, Berthelot, Girardin, Peligot, Ste. Claire-Deville, and numerous others of equal authority and reputation; and do not hesitate to say that it is one which will receive extensive patronage wherever the French language is read, few works now in existence affording so large an amount of information in a concise and intelligible form. To the great majority of persons, and especially those engaged in commercial pursuits, the construction of a technological dictionary is a most distasteful task, and it is gratifying to find that in the work under consideration the ordinary dictionary arrangement has been dispensed with, except that the industries treated of are placed in alphabetical order. The plan of the work originated, it appears, with Messrs. Barreswil and Aimé Girard. In going through the work, as the authors observe, the usual lexicon form of printing, and the class arrangement of chemical treatises, are neither found; and in designating their book a Dictionary, their sole object was to indicate the alphabetical order of the special and distinct treatises of which the collection represents the industrial chemistry of the present day. The introduction furnishes, in the briefest possible manner, the elements of those

* "Dictionnaire de Chimie Industrielle." Par MM. BARRESWIL et AIMÉ GIRARD, &c. Paris: Ferdinand Tandou et Cie., Rue des Ecoles.

sciences with which it is essential that the industrial chemist should be acquainted. The first chapter, which treats of generalities, explains Chemical Phenomena and Combinations, and defines Affinity, Cohesion, Crystallisation, and we have then a chapter on Nomenclature, by Berthelot, who also treats of Equivalents in the succeeding chapter and with reference to this latter, we may allude to one portion which forms a striking instance of the thoroughly practical manner in which the subject has been handled. Tables of equivalents are to be found in nearly every elementary work on chemistry, yet to a large number of students, without the advantage of a practised tutor, they have been a dead letter, through the mode of using them not being clearly explained. Mr. Berthelot observes, at the foot of his table of equivalents of simple bodies, that a few examples will show the use of the table in chemical operations, and says—Alumina being represented by the formula Al_2O_3 , how much aluminium and oxygen respectively will be contained in (say) 10 ozs. of alumina? Simple as is this question to those who have learned in the schools, there are very many practical men to whom it is a regular poser; yet the operation is simple enough: the tabulated equivalent for each element indicated is multiplied by the index, and their sums, which represent the equivalent for the given number of atoms, are added together, the total being the divisor for the equivalent of each element multiplied by the number of ounces. Thus the equivalent of aluminium is 13.7, and that of oxygen 8; therefore— $13.7 \times 2 = 27.4$ and $8 \times 3 = 24$; then $27.4 \times 24 = 51.4$; which is, consequently, the equivalent of Al_2O_3 , so that $27.4 \times 10 = 274$ — 51.4 gives 53.3 ozs. of aluminium and $24 \times 10 = 240$ — $51.4 = 67$ ozs. oxygen. More complicated formulas are analysed in the same way, so that the student has himself alone to blame if he do not become thoroughly master of the theoretical portion of the science. The fourth chapter describes the special characters of the different classes of bodies; there come chapters on the laws of chemical reactions, metalloids and their combinations, and metals and their combinations; a chapter on organic chemistry closing this section of the introduction. A section containing the elements of Physics follows, and this again is succeeded by Chemical Analysis, in which analysis by the ordinary wet way, by the blowpipe, and by the volumetric system are in turn described, a chapter on Organic Analysis concluding the volume.

Passing to the body of the book, we find admirable treatises upon Mineral Acids, on Organic Acids, and on Mineral Alkalies, all by Aimé Girard; on Vegetable Alkalies, by H. Aubergier; on Alums and Copperas, by Girard; and on Bleaching, by L. Troost. A treatise on Natural and Vulcanised India-rubber, by Martin, and an equally interesting one by G. Gérard on Gutta Percha follow. A chapter on Kelp Ashes by Girard, and a short paper by H. Lestell on Animal Black, close the volume. The second volume opens with treatises on Vegetable, Fossil, and Artificial Fuels; on the Preservation of Alimentary Substances; on Colours, by Barreswil; and on Electro-Chemical Deposits, by Bouillet, the son-in-law of Christofle, and a chemist of great experience in this department of the science. Next follow treatises on Mineral Waters, on Artificial Illumination, on Essences, Oils, &c., all ably written and highly interesting; but the next article in which our readers will be especially interested is that which commences the third volume—Metals in Ordinary Use, comprising elaborate papers on Iron, by E. Kopp; Copper, by E. Gaupp; Lead, by E. Lesieur; Zinc, by L. Fanta; Tin, Antimony, and Arsenic and Arsenicous Acids, all by Girard. Under the head of Rare Metals we find excellent papers on Mercury, Bismuth, Nickel, and Cobalt, by Girard; and Aluminium, by Ste. Claire-Deville and Paul Morin. The next section treats of the Precious Metals, by Girard, comprising chapters on Silver, Gold, Platinum, and Refining of Gold and Silver; and this is succeeded by treatises on Alloys, by Alfred Riche; Paper, by Barreswil; Pharmacy, by A. Vés; Phosphor Matches, by Barreswil; Photography, by A. Devanne, who has been most successful manipulator in photographic engraving; Pottery, by Salvaté; Powder and Saltpetre, by C. Collin; Soap, by Legrand; and Salt, by Balard, which concludes the volume. Aimé Girard contributes a highly interesting article on Sulphur and Sulphide of Carbon, which is followed by a paper by Bayvel, on the Manufacture of Sugar; next comes Tobacco, by Schlesinger; and then Dyeing Textile Fabrics, by Salvaté, and Printing them, by Girardin. Glass and Enamel is elaborately treated by Peligot, whilst an equally competent treatise, by J. A. Barral, on Wines and Spirits completes the Dictionary, an analytical table of contents being then given, which renders the whole of the varied information contained in the work readily accessible.

From even this brief outline of the contents of the work it will be seen that there are few branches of industry which are not touched upon, whilst, inasmuch as the editors are well and favourably known in the scientific world, and have selected their collaborators for their special and intimate acquaintance with the subjects upon which they write, there is an ample guarantee that the work may be consulted with the utmost confidence, whilst its completeness is such that upon a difficulty arising it will seldom be consulted in vain.

MARINE ENGINEERING.—A most carefully executed series of drawings, which cannot fail to be of immense value to mechanical engineers generally, has recently been issued, through Messrs. Spon, of Bucklersbury, by Mr. N. F. Burgh, under the title of "Practical Illustrations of Land and Marine Engines and Boilers." The plates, which are 20 in number, are designed to show in detail all the modern improvements in high and low pressure, surface condensation, superheating, &c., and comprise the working drawings of some of the best forms of engines and other machinery connected with the propulsion of steam-vessels that could be designed. The first plate contains three views of an ordinary high-pressure steam-engine of 12-horse power, on the scale of $1\frac{1}{2}$ in. to 1 foot, whilst the three following plates contain the details of the same engine upon a much enlarged scale—the feed-pumps, valves and box, relief valve, safety-valve, starting and governor-valves, engine feed-cock, boiler front doors, fire-bars, and supports being shown half-size, and the remainder on the scale of 3 in. to the foot. Plate 5 contains four views of the boiler and settings upon the scale of $2\frac{1}{2}$ in. to the foot. We have next a diagram of the very compact Little engine invented by the author, and known as Burgh and Cowan's Patent Antifriction Trunk Engine, upon a scale of $1\frac{1}{2}$ in. to the foot; the details being given on the same plate 3 in. to the foot. Plate 7 gives seven views of a marine-engine, direct-setting for the screw propeller, 400-horse power collectively; scale, $\frac{1}{2}$ in. to the foot. The four following plates contain the details of marine-engines of 200-horse power. Plates 12 shows seven views of oscillating engines for the paddle-wheel, 150-horse power collectively; and Plate 13 has two views of a paddle feathering wheel, on the scale of 1 in. to the foot. Plate 14 gives the details of a paddle-wheel, and this is followed with a plate containing five views of Griffith's Patent Screw-Propeller, with lifting frame, upon the scale of $1\frac{1}{2}$ in. to the foot. Five views upon the scale of $\frac{1}{2}$ in. to the foot, and showing the arrangement of a pair of marine steam-engines of 900-horse power for the Imperial Ottoman iron-clad frigate, "Sultan Mahmoud," constructed during the present year by Messrs. Ranshaw, Saltkeid, and Co., occupy Plate 16, and the following plate contains six views of a marine boiler, with superheating tubes. Plate 18 is occupied with a diagram of an ordinary condenser and air-pump for a screw marine-engine of 200-horse power, and eight views of an oscillating paddle-engine of 75-horse power; and Plate 19 with four views of a surface condenser of 200-horse power, upon the scale of $1\frac{1}{2}$ in. to the foot, whilst the concluding plate contains five views, showing the general arrangement of engine, boilers, shafting, and screw for a despatch boat, 100-horse power collectively, upon the scale of $1\frac{1}{2}$ in. to the foot. The whole of the particulars contained are given with such accuracy, and in so systematic a manner, that it would not be difficult to place the various parts of a single machine in the hands of 20 men with nothing more to guide them than the data given in the diagrams. Mr. Burgh has likewise just issued, through the same publishers, a "Pocket-Book of Modern Engines and Boilers for Land and Marine Purposes," which will not only form a useful companion to the plate, but will also be of great practical utility, alone, to the foreman engineer and superintendent of an engineering establishment.

APPLICATION OF CAST AND WROUGHT IRON TO BUILDING PURPOSES.—The third edition of the very valuable work, by Mr. Wm. Fairbairn, bearing this title has just been issued through Messrs. Longman. In the present edition, which, indeed, is almost entitled to be regarded as an entirely new work, Mr. Fairbairn has brought the subjects treated of down to the present state of our knowledge of constructive art, and he has introduced many additions and improvements that have occurred since the last publication. His remarks that wrought-iron beams and girders are, to some extent, superseding cast-iron in the construction of fire-proof buildings, and for this reason, he gives examples upon a scale sufficiently large to ensure increased security for the support of arches, or any other description of flooring which the character of the building may require. The section on wrought-iron bridges has been enlarged with additions and examples, calculated to determine the effect of the varied and different forms now in use. Those on the lattice principle he has investigated experimentally, and in this edition will be found formulae from which to calculate the position and strains on the struts and tension-bars of these important structures. The general character of Mr. Fairbairn's work is so well known, and that its utility is fully recognised has been so thoroughly proved by the patronage which the former editions received, that it is unnecessary to describe the details given. The work has been for some time out of print, and its re-issue, especially with extended information, will be gratifying to a large number of readers.

HOW TO OBTAIN A PATENT.—A pamphlet containing a large amount of information, compressed into a small space, has just been issued by Mr. Tweedie, of the Strand, under the title of a "Handy-book for Inventors and Patentees. By a Solicitor." From many of the remarks it would

THE LAW OF JOINT-STOCK COMPANIES.

[FROM A CORRESPONDENT.]

The apparently premature termination of the case of "BALE v. CLELAND and others," which had occupied Mr. Baron MARTIN and a special jury nearly three days, at the Guildford Assizes, could scarcely have been a surprise to any person. When we originally advocated the principle of limited liability, and took a very prominent part in pressing upon Parliament and the country the policy of the measure, which subsequently became law, we advocated it as a means of investing the capital of the many, and securing a general distribution of profits amongst the members of the community, but we anticipated that some cases might, from time to time, occur to bring the system into partial disrepute; and we confess we feel surprise that amongst the multitudinous operations to which that measure has given rise those cases have been so "few and far between." The numerous new companies which are daily in course of formation, and the many amalgamations which are taking place, ought to satisfy the public that but little is to be apprehended from the disclosures made in this isolated case of mismanagement, for as such it must be described. The learned Judge early saw that, with all the array of counsel, and, as Mr. BOVILL remarked, the full strength of the company on the Home Circuit was engaged in the performance, the question would resolve itself into a very simple one—had there or had there not been too ardent expectations and promises of realising profits held out as an inducement to parties to purchase shares? Men entering into speculations generally calculate for themselves, and in the present instance Mr. BALE very properly took the precaution of inspecting in person the works of the Asphaltum Company (Limited), at Millwall, so that the maxim "caveat emptor" was applicable to him. Strange to say, his visit to the works did not enable him to state on the trial whether the report of the number of stills in operation was correct or not, so that he could scarcely complain of being misled in that respect. When sued for the calls upon his shares, he put forward a plea of fraud in connection with the company, and endeavoured to sustain it on the ground that instead of confining themselves to making oil from asphaltum, they had manufactured petroleum—that defence wholly failed. Having been forced to pay or settle for his shares, the present action was brought by Mr. BALE, to recover back the money which he had paid for shares, on an allegation that he had been the victim of representations so exaggerated as to be fraudulent; and a contemporary has expressed regret that the case was withdrawn from the jury, who were thus deprived of the means of affirming by their verdict the truth of this allegation. Our regret, on the other hand, is that the case was ever permitted to go so far, and that the lawyers were ever instructed to throw such difficulties in the way of ascertaining the facts, but we can scarcely regret further unpleasant disclosures were cut short by a tardy compromise.

The main allegations against the projectors and the directors would seem to be twofold—first, that they put forward exaggerated reports, and a delusive balance-sheet, at a time when they had a correct one in their possession; and, secondly, that they paid dividends out of capital, and not out of profits, of which there were in reality none. As the arrangement of the case of "BALE v. CLELAND," between the parties themselves, without any exposition of the law, will prevent it from ever becoming a judicial authority, we think it right to lay before our readers the very recent judgment of the highest tribunal known to our law, that of the House of Lords on the abstract questions involved in the first proposition. The case to which we refer is that of the "New Brunswick and Canada Railway and Land Company v. CONYBEARE," decided on appeal from the Lords Justices in February, 1862, and the questions raised were—1. Whether reports made by the directors of a company, and afterwards adopted and circulated by the company, were binding on the company as statements made by its authority?—2. Whether if such reports are afterwards shown to have been the immediate cause of a purchase of shares in the company, and to have been untrue, the company can retain the money thereby acquired? The Lords Justices did not think the charge of misrepresentation made out, and the present LORD CHANCELLOR, in moving the reversal of their judgment, distinctly laid down these general propositions in favour of Mr. CONYBEARE, who sought to be relieved from a contract:—"With regard to the reports produced to the plaintiff by the secretary, I certainly am not at all disposed to advise your lordships to throw any doubt upon this doctrine, that if reports are made to the shareholders of a company by their directors, and the reports are adopted by the shareholders at one of the appointed meetings of the company, and those reports are afterwards industriously circulated, misrepresentations contained in those reports must, undoubtedly, be taken, after their adoption, to be the representations and statements made with the authority of the company, and, therefore, binding on the company. Neither, my lords, do I think it would be at all expedient to question this conclusion, that if these reports, having been industriously circulated, shall be clearly shown to have been the proximate and immediate cause of shares having been bought from the company by any individuals, or subscribed for by any individuals, and they are proved to have been untrue, it will be impossible, consistent with the principles of equity, to permit the company to retain the benefit of that contract, and to keep the purchase-money so paid. There may be a very different consideration applied to the same transaction in a court of law and in a court of equity, because, when an attempt is made in a court of law to render a party liable to damages for certain consequences of a misrepresentation, it is necessary to prove that the individual was aware at the time of the falsehood of the representation, or ought to have been so aware; but with regard to a claim for the restoration of property, acquired through false representations made by an individual acting in the capacity of agent, though the company was no party to those representations, and did not distinctly authorise them, it would still appear to be inconsistent with natural justice to permit property so acquired through the medium of these representations to be retained by the company." (9th House of Lords' Cases, pp. 725-6.) Mr. BALE brought his action to recover back his money paid, as he alleged, under circumstances similar to those above referred to; and it may be inferred that the principles so emphatically laid down, applied at law equally as in equity to his claim.

With respect to the second question, declaring dividends out of capital and not out of profits, we are aware that it has been repeatedly done both in insurance and railway companies. The House of Lords had declared, in the case of "BURNES v. PENNEL" (2 House of Lords' Cases, p. 497), that dividends, unwarranted by the real financial condition of the company, ought not to be paid; and in the case of "EVANS v. COVENTRY," the Court of Chancery decided "that the declaration of dividends out of the funds of a company were breaches of trust, and that the directors were liable to make good the same, with interest at 4 per cent., without prejudice to their rights against the shareholders who had received the dividends." There was, however, no provision in the original Joint-Stock Companies Act (1856), which regulated limited liability, rendering the payment of such dividends illegal. The General Act of 1862, "For the Incorporation, Regulation, and Winding-up of Trading Companies and other Associations," 25 and 26 Vict., c. 89, which constitutes the code of law on the subject, is, however, express. In the first schedule, Table A—"Regulations for Management of a Company Limited by Shares"—there is this plain direction:—(73) "No dividend shall be payable, except out of the profits arising from the business of the company." It is true a company is not under the strict words of the Act imperatively bound to adopt the regulations in Table A, but its insertion would probably be considered, and would seem to have been so by the learned Judge, as indicating the intention of the Legislature, that a departure from the principle would go far to vitiate the acts of the company, and the facts certainly formed an element in the case to entitle Mr. BALE to recover back the money paid by him for shares that prove valueless.

A witness was examined on the trial who proved that he had been employed as an agent on a commission for the sale of the shares of the company, and had disposed of many. It may, however, be well for parties to bear in mind that in cases of this nature a responsibility attaches to such an employment. That very question of liability lately arose in a Scotch appeal case, "CULLEN and THOMPSON," also before the House of Lords. The action was founded on false and fraudulent representations contained in the reports of a company by the directors to its shareholders, and was brought against one of the directors and two of its officers—the manager and assistant-manager. The Scotch Court thought that there was sufficient ground of action against the directors, but not against the officers, who were mere servants, and must be treated as having acted under the direction and control of the directors. The House of Lords reversed that decision, and the language of the Lord Chancellor, Lord WESTBURY, is highly important, as defining the responsibility of a subordinate or agent

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responsible for the consequences? All persons directly concerned in the commission of a fraud are to be treated as principals. No party can be permitted to excuse himself on the ground that he merely acted as the agent or servant of another; and the reason is plain, for the contract of agency or service cannot impose any obligation on the agent or servant to commit or assist in the commission of fraud."—"Upon principle I think it right that in cases of fraud the remedy should be co-extensive with the injury, and that a right of action should be given to the party injured by the fraud against all persons who joined in committing it, although the consciousness of some of those persons may be unknown to the party injured at the time of the injury; and such, I consider, upon the decided cases to be the actual state of the law."

It would seem, therefore, upon the broad principle thus laid down, to be the duty of an agent, before he embarks in the sale of the shares of a company, and relies upon the reports of its directors as inducements to parties to purchase, from which purchases he derives a profit, to use, at all events, no diligence in enquiring into the truth of the representations contained in such reports. A person assuming such an agency may be misled innocently, but if he misleads others with the means of acquiring accurate information within his reach, he may possibly find himself, as well as the directors by whom he was employed, equally visited with a serious legal responsibility.

PREFERENCE SHARES IN WINDING-UP.—In the case of the *Cornubia*, the Mining Company, heard before the Vice-Warden of the Stannaries, His Honour remarked that it is apparent that questions of considerable legal difficulty are imminent, involving the validity of certain preference shares and calls thereon, which are likely to constitute the larger half of the present prospective assets. There is also a mortgage of the plant on the mine, made at about the same date as the presentation of the first petition to wind-up, and a subsequent sale of the mine itself and machinery thereon, by direction of Mr. Fowell, then acting as liquidator, under a resolution of the company to wind-up voluntarily, and while a petition to wind-up was pending, which was afterwards dismissed. He thought that, considering the circumstances of the company, some common partial sacrifice on the part of claimants may be preferable to the discussion in Court of disputed facts and questionable points of law, for the expense of this and other Courts gives little reason to expect that 20s. in £1. will ever be got out of a limited company, whether the winding-up be voluntary or compulsory.

PROMOTED LIQUIDATORS.—The Vice-Warden observed, in the case of the North Hallenbeagle winding-up, that the Superior Court has expressed so strong an opinion against the employment of liquidators connected with the company by office or shares, that he felt reluctance in sanctioning the appointment of the company, some common partial sacrifice on the part of claimants may be preferable to the discussion in Court of disputed facts and questionable points of law, for the expense of this and other Courts gives little reason to expect that 20s. in £1. will ever be got out of a limited company, whether the winding-up be voluntary or compulsory.

OLD WHEEL NEPTUNE.—We alluded a few weeks since to the intended application to the Court of Stannaries to convert the Vice-Warden's order for continuing the voluntary winding-up under the supervision of the court into a simple compulsory winding-up. This the Vice-Warden has refused.

In delivering his judgment the Vice-Warden said that this was a motion made by Mr. Marrack to vary the order of this Court, made on May 18 last. This order has since been the subject of appeal by Mr. Fulbrook, and has been confirmed. Mr. Marrack says that the order may be converted into a simple compulsory order to wind-up, or that another liquidator should be appointed, or that Mr. White may be discharged from the office of liquidator; and he refers to the power indicated by sections 150 and 152 of the Companies Act, 1862; and he alleges certain difficulties that have occurred in the employment of the two liquidators, and the want of unanimous co-operation between them, and apparent disposition on the part of others, to create difficulties and cause delay. He further applies for liberty to sell the plant and machinery on the mine by private contract or public auction. Mr. Marrack proposes to represent the petitioning creditor or whose petition the order was made; one of the liquidators, Mr. Polkinghorne; and a number of local creditors, amounting to 700, and upwards. This application is opposed by Mr. Stokes, who represents Mr. White, the other liquidator; Mr. Fulbrook, contributory and creditor, the applicant in the two late appeals; and the company, whose town solicitors are Messrs. Benham and Tindell. Mr. Josiah Harris, the grantor of the sett, also appears, by Mr. Cock, his solicitor, to claim pre-emption of the plant and machinery on the mine, under covenants contained in the grant, by force of which he has revoked the sett in July last for breach of covenant, and now insists on his right to buy the plant, &c., at a valuation. He produces the original grant which contains the above stipulations. Several affidavits have been put in, but I do not think it necessary to advert to them particularly. They complain that Mr. Polkinghorne has done nothing since his appointment, and that his solicitors retain in their possession three of the books of the company, and refuse to hand them to Mr. White. There is a long one of Mr. Fulbrook, that has little pertinence, except to exonerate himself from a charge of not noticing letters which he alleges that he never received. There is a strong testimonial by Messrs. Benham and Co. of Mr. White's competence and experience as a liquidator. I will address myself only to the material matters before me. I see no good reason, at present, to make any alteration in the order already made, or to convert it into a simple, compulsory order to wind-up by the Court. It appears that Mr. White is willing to act, and has taken steps in his office which seem to have been proper ones under the circumstances. Mr. Polkinghorne has been advised not to act until the determination of the appeals of Mr. Fulbrook. They were dismissed in the latter end of July. The delay has been occasioned chiefly by these appeals—appeals which would have done no good to the creditors or the company even had they been successful; and which seem to have been chiefly dictated by a desire on the part of the applicant to continue to be liquidator. I see no good reason to apprehend that Mr. White, who, I am assured, is a very competent person for this office, should not work in harmony with Mr. Polkinghorne, whose competency and respectability is equally undisputed. It appears that these books, used at the hearing of Fulbrook's petition in May, were left by him in the custody of the Court. White has since applied—not for inspection, which is never denied by the Registrar of the Court in such a case—but for possession of these books, which the Registrar declines to give without further instructions of the Court. I think it clear that both liquidators are entitled to inspect and examine all the books and papers of the company, of which some are already in the custody of Mr. White. My order on the subject of these is as follows:—Let the books of the company now in the office at Truro, and also the books and papers of the company, be deposited on or before the 6th day of September next at Messrs. Gregory and Co., Bedford-street, as the agents of my secretary, Mr. Protheroe Smith, to be kept in their custody for the inspection and examination of either of the liquidators, or their solicitors or agents, at reasonable hours, with liberty to take notes thereof, or copy the same or any part of them, a note or inventory of such books and papers being deposited with them at the time of delivery thereof—such books and papers not to be removed out of such custody except by order or written consent of the Vice-Warden or Registrar of the Court, which may be applied for in a summary way and without motion. The other subject of application relates to the motion and proposal of Mr. Harris, made through Mr. Cock, claiming that his revocation of the grant and right of pre-emption should be recognised by the Court. He has notified his willingness to buy the machinery, &c., at the price of 2000, to be paid partly in cash and partly in good bills; and he expresses his willingness to facilitate a valuation in such a manner as in the discretion of the Court shall seem fit. This is a matter on which the advice of the liquidators is required. I do not think that the claim of Mr. Harris can be successfully contested. Mr. White has paid particular attention to this matter, and has consulted a surveyor of known skill. It will be desirable that the two liquidators should, if possible, let me have a joint opinion as to the expediency of accepting this offer, and under what modifications, if any. I will only suggest that, in a winding-up matter, the less we have to do with bills or notes the better; but such a proposal may be fairly entertained. If, in the result, the proceeds of this sale should cover the claims of creditors and all necessary expenses of the proceedings, the company would then be in a condition to apply for a stay of all further proceedings, under the order to wind-up (section 89 of the Companies Act, 1862), unless the interest of the contributaries themselves should require the continuance of them for their own purposes. It must be borne in mind that the expenses and remuneration of the liquidators must not be materially increased by the fact that the duties are performed by two instead of one. If each shall employ his own separate solicitor, it will be evident that some arrangement should be made between the respective liquidators, as well as between the several solicitors. The costs of these motions to be reserved. Refer Mr. White to a copy of the order made on May 18; he can, no doubt, get it through his solicitor.—West Briton.

COMPOSITION DEEDS.—In re *Brooks* it has been decided by the Lord Chancellor that a non-accepting creditor can call upon the Court of Bankruptcy to sum up a debtor for the purpose of examining him, to show that the deed is valid; in this respect accepting and non-accepting creditors are on the same footing. The old rule in bankruptcy, refusing to hear against the adjudication a creditor who had not proved, does not furnish a rule by analogy, whereby a non-accepting creditor is to be treated as the right of examining the debtor against the registration, for in the former case the result of the application, if successful, would have been held to destroy the jurisdiction; whereas in the latter case the result will probably be to establish the jurisdiction of the Court against the deed as an act of bankruptcy. Exceptions to the right of examining the debtor, where the creditor insists on holding the debtor in prison, or his retaining property for his own exclusive use, which is sought to be recovered by the deed, or in defending an action in which the trustee or the debtor is plaintiff.

LIABILITY UPON GUARANTEES.—The Court of Exchequer Chamber has reversed the judgment of the Queen's Bench, in the case of *Bingham v. Corbitt*. The defendant had given the plaintiff a continuing guarantee for 2000, for goods supplied at two months' credit, and a liability having accrued under it, the debtor executed a mortgage of certain property as a security to the plaintiff for the sum then due, and for any further sum which might become due on the guarantee, with a covenant to the same within six months after they became due. Goods were supplied subsequent to the execution of the mortgage to the value of 2000, but at a two months' credit, as before the mortgage. The Court of Exchequer Chamber held that the position of the surety was not prejudiced by the mortgage, which was merely a collateral security to the personal security.

PETROLEUM.—The exact source of petroleum is, up to the present, uncertain—whether it has all been produced by distillation from bituminous coal, antracite being formed at the same time; or whether it has resulted directly from the bituminous fermentation of marine plants, the coal, and containing a larger proportion of hydrogen.—*New York Journal of Science*.

IMPROVED SELF-ACTING SPANNER.



PATENT L. SCHWARTZKOPFF

Some few months since an improved self-acting wrench, or spanner, was patented by Mr. L. Schwartzkopff, the well-known ironfounder and mechanical engineer of Berlin, and as the invention is now being introduced in this country, we take the opportunity of giving an illustration of the tool, that its merits may be at once understood and appreciated. The simplicity of the wrench will be seen from the drawing, whilst its advantages, as compared to that in general use is, that it readily adapts itself to any sized nut or screw which it may be desired to turn, and that circular, square, hexagonal, and other forms of nuts are turned with equal facility; the wrench is also applicable for screwing and unscrewing gas-pipes. One of the jaws is fixed and the other moveable, the latter sliding in the forked part of the former; the moveable jaw is connected by a link to the handle, so that the movement of such handle, in the action of turning, tightens the jaws upon the nut or screw to be moved; the pressure corresponding with the force applied to the handle.

In the above diagram, *a* is the handle or stem of the wrench which forms the main lever. The inner end of this lever moves in the forked part of the fixed jaw, *b*, and turns upon the fulcrum formed by the bolt, *c*; *d* is the second, or movable jaw, which is connected with the slide, *e*, also moving within the forked part of the fixed jaw; *f* is a link of steel moving on the two joint pins, *h* and *i*, and connecting the handle with the slide, *e*. It might appear at first sight that the strength of the tool would be limited to the strength of these joint pins, but such is not the case; for in closing the jaw upon the nut the steel link is, by a small cam, cut in the lever against the slide, *e*. By moving the lever or handle, *a* (which is capable of moving to the right or left), upon the pin, *c*, the link, *f*, is pressed forward, and with it the slide and moveable jaw; consequently, the space between the two jaws will be of greater or less extent, according

to the position of the lever; the power of the grip corresponding in all cases with the power applied on the handle. It will be readily understood that the more difficult the nuts or screws are to unscrew the more force will have to be exerted upon the handle, and the harder the jaws will be pressed together upon the nut. On the other hand, as the wrench cannot slip the nut must give way when screwing or unscrewing with it; but the jaws can be easily removed from the nut by turning the handle in the opposite direction.

The effect of the combination of the lever, *a*, and the straight bar or link, *f*, in pressing the moveable jaw, *d*, against the nut to be operated upon, is equal, as the inventor very truly states, to that given by toggle-jointed levers, as used in old printing presses. The pressure exerted upon small nuts is very considerable, and makes a slip of the wrench almost impossible, which if the pressure of the jaws be constant, as is the case in other wrenches, will easily occur in screwing or unscrewing nuts of smaller size, by reason of the shorter sides of the same. And as the fault just mentioned occurs in the mechanical wrenches hitherto known, in which the moveable jaw is furnished at its lower part with a rack geared with a toothed segment on the end of the main lever, the new wrench, constructed according to this invention, is an improved substitute for it. While the jaws are firmly gripping the nut, if the nut be forcibly turned, the edges or sides of the nut cannot be injured, which is unavoidable if the moveable jaw gives way, or a wrench of the old construction be not exactly fitted for the nut to be screwed or unscrewed. The simple construction of this wrench, its security, and manageable application make it superior to all wrenches constructed for the same purpose. It will be obvious that the invention is capable of several modifications in detail, so as to be applicable to every variety of purpose.

MANUFACTURE OF CHLORINE.—Many means have been employed for the manufacture of chlorine, including the application of the bichloride of copper and other bichlorides, but hitherto without success. Mr. de Tregomain has patented an invention which relates to improvements in the manufacture of chlorine by means of bichlorides, and also to the method of revivifying the latter. After the bichloride, which is heated to a deep red, has disengaged about half its chlorine, and has changed to a state of protochloride, he collects it, while in a state of fusion, and pours it on marble slabs, and then grinds it in a mill. The powder he obtains is introduced into a revivifying apparatus, in which he passes a current of air of sufficient amount, when the protochloride in powder, in coming in contact with the oxygen of the air, becomes changed into oxychloride, or mixture of chlorine and bichloride of copper. In order to effect the revivification, he places the powdered oxychloride in stoneware vessels, containing hydrochloric acid at 28° Beaume, in the proportion of about 1 cwt. of dry oxychloride to 100 lbs. of acid. The matters are then heated, cooled, and crystallised, and the mother waters drawn off, the crystals being dried and distilled over again.

UNITING METALLIC SURFACES.—Some improvements have been invented by Mr. Barnard, of Waterbury, Connecticut, which relates chiefly to the manner of forming the holes in the surfaces of metallic vessels or plates, into which the rivets are driven, and to the mode of preparing uneven surfaces to receive the sheathing or lining. When metallic surfaces are united by means of rivets, suitable holes are formed in the under or thicker surface. For contracting the outer ends of these holes, a taper punch is employed. By blows upon this punch a countersink is produced in the mouth of the holes, while they are interiorly enlarged. When rivets are driven in the holes thus prepared, they entirely fill the interiorly enlarged cavities, and are thereby firmly secured in the under surface. In joining metallic plates to form the sides of vessels or other extended surfaces, the edges are usually lapped, or the plates are joined together by means of bats, secured over the joints, thereby producing broken or uneven surfaces. The angular spaces formed by the lapping of the plates, or the battening of the joints, are filled with bevelled or wedge-shaped pieces. The principal object of these pieces is to secure a surface for sheathing or lining, free from corners or sharp angles, though these pieces may be formed of, or coated with, a suitable adhesive substance, for the purposes of keeping them in position and effectually preventing any leakage of the joints.

IMPROVEMENTS IN PUDDLING FURNACES.—An invention which relates to improvements in the construction of the boshes of the furnace has been patented by Mr. M. J. Davies, of Zanesville, Ohio, the object of which is so to form the inner surfaces of the boshes that the said surfaces will serve to hold up in place and prevent the falling down of a protecting composition or layer. The boshes of ordinary boiling or puddling furnaces are commonly made of cast-iron, inclined and smooth on their inner or fire surfaces, and so constructed and set in surrounding fire-brick that a current of cold air circulates under the locks of the plates composing the boshes, and prevents them from becoming melted. As a further preventive against the destruction of the boshes, it is common to "fix" or protect the boshes by placing against them a layer or layers of iron ore in lumps, while a layer of iron scrap is placed upon the bottom or hearth. The ore and scrap are then partially proved, and form a protection from the boshes and bottom, under the intense heat to which they are exposed during the subsequent process of boiling or puddling. The ordinary fixing or preparing of the furnace to receive a charge for puddling is a work of much labour, requires from two to three hours' time, and involves the consumption of a considerable quantity of fuel. This improvement overcomes the above difficulties, dispenses with and saves the time, labour, and expense of the usual fixing, and the attendant losses of fuel, ore, scrap iron, &c. For this purpose the inside faces of the boshes are constructed with a series of step-like ridges, recesses, or corrugations, which serve to hold or retain a protecting composition, which is thrown upon the said ridges, recesses, or corrugations, and the hearth, preparatory to charging the furnace. The protecting compound is composed of lime, ore-clay, iron ore, tap cinder, and iron scales. But any other suitable protecting medium or compound may be employed.

IMPROVED STEAM VALVE.—Mr. W. H. Atkins, of Dryden, New York, has invented a valve, which consists in a solid plug, provided with a cavity, and fitted in a case surrounded by an annular steam-chamber, furnished with three or more ports, and divided off in three or more separate compartments—one to communicate with the interior of the cylinder, one with the steam, and another with the exhaust pipe—in such a manner that the plug is relieved from all, or nearly all, pressure of steam, and, therefore, can be moved instantaneously, and by turning the said plug over the small arc the interior of the cylinder can be brought to communicate either with the steam or with the exhaust pipe as circumstances require.

ADJUSTABLE ISSUE WHEEL.—Mr. P. Dickson, of Erie, Pennsylvania, has patented a water-wheel, which is intended to be self-regulating as regards its speed and power. When the speed of the wheel becomes too great, the water is not allowed to exert much force, but when more power is required the full head of the fall is directed upon the buckets. Inside the buckets there are sliding gates, that are also buckets in one sense, which are connected with levers on the top. The ends of these levers all play in a slotted wheel or gear on the main shaft, which is not keyed to the wheel itself. The opposite ends of the levers connect with the sliding gates before mentioned, so that when the wheel meets with great resistance it twists slightly on the shaft, which causes the levers to open the gates, so that the water can escape freely. In this way the wheel constant regulates itself for the amount of work to be done. The elliptic spring does not yield when the wheel is running at a low speed, but when the power is to be increased it gives, and allows the levers to act as before stated.

QUICKSILVER—HOW TO TEST IT AND DETECT ADULTERATION.—Quicksilver, after being extracted by the plain process of retorting, is seldom quite pure, and generally contains a small proportion of other metals. The eminent naturalist Priestly suggests a very simple method to purify mercury, by merely shaking it strongly in an iron flask, and renewing the air in the same repeatedly with a pair of bellows. By this manipulation black powder will be formed on the surface, which can easily be separated. If no more of this dust is formed the quicksilver may be considered pure. In this state it will always give a clear sound when agitated in the flask, while an admixture of lead will make it sound dull, as if the vessel were made of potter's clay. It is often found in the market wilfully adulterated with lead, tin, and bismuth. Of lead, it can absorb or dissolve almost one-half of its weight, without losing much of its liquidity. This adulteration can easily be discovered by rubbing some of the metal on the open palm; if it soils the skin it is adulterated—if pure it leaves no trace. Besides, if doused with lead, it will leave a tail behind—"il fait la queue," to use a French expression—that is, the drops, instead of being globular, will assume an elongated form, and a more or less flattened surface. Some of these observations may be, perhaps, useful to the gold miner, as many complaints have lately been heard about the impurity of the quicksilver sold in the mines, which fact is also proved by the frequent occurrence and admixture of base metal in the amalgam gold, probably, in most cases, by artificial means.—*San Francisco Mining and Scientific Press*.

THE MAGNESIUM LIGHT NO NOVELTY.—Alluding to the use of the magnesium light for photographic purposes, the "American Journal of Photography" remarks, that the metal magnesium has now been known for upwards of half a century. Its discoverer observed that it burns with a bright light, a fact which in the absence of any trial might easily have been predicted from the nature of its products of combustion. The magnesium light so much talked about is, therefore, no novelty; someone has, however, recently observed that wire is the most convenient form in which to have the metal for burning, and this clever observation has brought the light into notoriety. The burning of magnesium wire is a very pretty and instructive chemical experiment; it is very interesting to see a silver white metal ignite and burn vividly in a lamp-flame. In our opinion, magnesium has not been found to possess any other practicable virtue. If magnesium were as cheap as lead, it might under some circumstances rival gas, or rock oil, as an illuminating material, and were it as cheap as silver, and could produce the brilliant

magnesium light which some enthusiastic persons have seen, it might be useful for some photographic purposes, as a rival to the lime light. But the plain fact is that the intensity and brilliancy of this light have been enormously exaggerated. The light from a magnesium wire, burnt in a spirit lamp-flame, is not greater, and perhaps not more intense, than a good coal-oil lamp will give, and it is not at all comparable with the lime light. But our enthusiastic English friends tell us that photographs have been made by it, and that it has extraordinary active properties. In the winter of 1840-41 a daguerreotype was made at night before a large audience, by means of the lime light, and since that time similar experiments have been, at least in America, a common lecture-room illustration. We have made an ambrotype by the light of coal-oil lamps, and it is a common thing to produce transparencies by gaslight. To believe the English journals, one Mouie has been for years making photographs at night with a kind of gunpowder, &c. This magnesium light is surely a case of "great cry and little wool."

SALES OF COPPER ORES.

COPPER ORES SOLD AT THE SWANSEA TICKETINGS FOR THE QUARTER ENDING JUNE, 1864.

Mines.	BRITISH. Tons.	AMOUNT.
Berehaven	3404	£29,265 5 6
Knockmahan	2897	26,464 7 0
Slag, Regulus, and sundries	578	4,255 15 0
Connor	716	1,949 16 0
Ballycumisk	77	609 13 0
Laxey	127	571 10 0
Cappagh	35	344 5 0
Holyford	14	193 4 0
Dyngwym	14	141 15 0
Croneband	26	89 12 0
Tigrone	13	70 10 0
Dhuoro	17	62 1 0
Gourock	11	54 5 0
Crookhaven	8	26 13 0
Total	7937	£54,788 11 6

FOREIGN.

[SEPT. 10, 1864.]

MESSRS. KNOWLES AND BUXTON, CHESTERFIELD.
MANUFACTURERS OF PATENT TUBULAR TUYERES.



The PATENT TUBULAR TUYERE possesses GREAT ADVANTAGES over the ORDINARY TUYERES, both for its DURABILITY and EASY WORKING. A current of cold water going direct to the nozzle prevents their destruction, however much they may be exposed to the fire.

We repair them at half the first cost, making them equal in size to new ones, all parts returning them carriage paid.

No. 1 tuyere, 16 in. long	28s. each.
No. 2 " 18 "	32s. "
No. 3 " 20 "	36s. "
No. 4 " 22 "	40s. "
No. 5 " 24 "	44s. "

Delivered at Chesterfield station. Terms, net cash quarterly.

Gun Cotton Manufactory.

MESSRS. THOMAS PRENTICE AND CO., GREAT EASTERN CHEMICAL WORKS, STOWMARKET, SUFFOLK.

This manufactory has been established for the purpose of preparing GUN COTTON, according to the Austrian process, and was opened on the 26th of January last, under the inspection of Baron Lenk. Messrs. Thomas Prentice and Co. are now able to SUPPLY GUN COTTON, in its most approved form, either for the purposes of engineering and mining, or for military and submarine explosion, and for the service of artillery, as a substitute for gunpowder.

The advantages of Baron Lenk's GUN COTTON are the following:—

For PURPOSES OF ARTILLERY.—The same initial velocity of the projectile can be obtained by a charge of gun cotton one-fourth of the weight of gunpowder. There is no smoke from the explosion of gun cotton; it does not foul the gun, nor heat it to the injurious degree of gunpowder. There is much smaller recoil of the gun. The same initial velocity of projectile is produced, with a shorter length of barrel. In projectiles of the nature of explosive shells it breaks the shell more easily into much more numerous pieces than gunpowder. When used in shells, one-third the weight of gun cotton produces double the explosive force of gunpowder.

For CIVIL ENGINEERING AND MINING.—In driving tunnels through hard rock a charge of gun cotton of given size exerts double the explosive force of gunpowder, thus a smaller number of holes is necessary. It may be so used as, in its explosion, to reduce the rock to much smaller pieces than gunpowder, and so facilitate its removal. As gun cotton produces no smoke, the work can proceed much more rapidly, and with less injury to the health of the miners. In working coal mines the advantages of bringing down much larger quantities of material with a given charge, and the absence of smoke in the explosion, enable a much greater quantity of work to be done in a given time at a given cost. The weight of gun cotton required to produce a given effect in mining is only one-sixth the weight of gunpowder. In blasting rock under water the wider range and greater force of a given charge is a great element in cheapening the cost of submarine work. The peculiar local action of gun cotton, to which the effects of gunpowder show no analogy, enables the engineer to destroy and remove submarine stones and rocks, without the preliminary delay and expense of boring chambers for the charge.

For MILITARY ENGINEERING.—The facility of transport is increased, the weight of gun cotton being one-sixth that of gunpowder. The peculiar localised action of gun cotton facilitates the destruction of bridges and palisades, and every obstacle. For submarine explosion, gun cotton has the advantage of a much wider range of destructive power than gunpowder. For the same purpose gun cotton, from its lightness, has the advantage of keeping afloat the water-tight case in which it is contained, while gunpowder sinks it to the bottom.

For NAVAL WARFARE.—In the batteries of ships, between decks, and in casemates for naval warfare, the absence of smoke facilitates continuous rapid firing. The absence of fouling and of heating are equally advantageous for naval as for military artillery.

GENERAL ADVANTAGES.—Time, damp, and exposure do not alter the qualities of the patent gun cotton. It has already been preserved 10 years without injury or decay. It can be transported through fire without danger, simply by being wetted, and when dried in the open air it becomes as good as before. In the case of a ship, or a fortress, or a city being on fire, this quality may be of the greatest value. It is much safer than gunpowder, owing to its being manufactured in the shape of rope or yarn. It cannot escape from its package, or be spilled by accident. The patent gun cotton is entirely free from the danger of spontaneous combustion, and secures that degree of safety and certainty which, at the time of the original invention, the gun cotton of Schönbein did not possess.

Messrs. THOMAS PRENTICE and Co. are now in a position to contract with the owners of mines, engineers, contractors, and governments for gun cotton prepared in the various forms required for their use. Mining charges will be supplied in the rope form, according to the diameters of bore required, and gun cotton match-line, as well as instructions for using it in mines, will be supplied with it.

The great advantage of gun cotton makes its use in practice very much cheaper than its comparative price would appear to show; in blasting rock, for example, the rapidity and quantity of the work done, with a given expense of wages, &c., is largely in favour of gun cotton.

Messrs. THOMAS PRENTICE and Co. are also prepared to manufacture the gun cotton, and deliver it in the form of gun cartridges, adapted to every description of ammunition; all they require for this purpose being a drawing of the gun, gunpowder cartridges, and ammunition, with the specification of weights, sizes, and initial velocities.

Artillers who prefer to manufacture their own cartridges may make special arrangements with the patentees through Messrs. PRENTICE and Co.

Stowmarket, March 10, 1864.

TO IRON AND COAL MASTERS, MINING AND QUARRY COMPANIES, &c.

IMPROVED BLACK VARNISH, FOR PREVENTING IRON FROM RUST, AND WOOD FROM DECAY.

A BRILLIANT JET BLACK, SUPERIOR to PAINT in APPEARANCE, dries in less time, contains preservative qualities of the best description, and is economical in its use; one gallon, at 1s., is equal to 14 lbs. of paint, which costs 4s. For COLLIER HEAD GEARING, RAILWAY WAGONS, BOILERS, CASTINGS, CANAL BOATS, &c., it is especially adapted. In casks containing 10, 15, and 20 cwt. each. In quantities of 1 ton and upwards, price £11 per ton.

TURPENTINE SUBSTITUTE.

GLOVER and Co. have now on hand a really splendid painting sample of spirits of turpentine substitute, a pure crystal, not more volatile than the genuine American turpentine, and quite inoffensive to smell. Price, 2s. per gallon, in 30-gallon casks.

PETROLEUM.

This oil gives a pure, white, soft, and brilliant light, easily regulated, and portable. For works or public buildings, where gas is not desirable, the brilliancy and economy of the article are unequalled.

WASTE NO OIL.

STRONG IRON OIL CISTERS. Not liable to leak, and which economise space in the stores. From 600 gallons, 48 diameter by 84 in. height, price £10 10s., down to 10 gallons, 15 diameter by 21 in. height, price 15s., with every variety of size and price between.

STRONG IRON BUCKETS.

2½ gallons. 4s. 6d. 3 gallons. 5s. 6d. 3½ gallons. 6s. 6d. 4 gallons. 7s. 6d.

WAGON GREASE.

GLOVER AND CO., No. 40, MANESTY LANE, LIVERPOOL.

B ASTIER'S PATENT CHAIN PUMP APPARATUS FOR RAISING WATER ECONOMICALLY, ESPECIALLY APPLICABLE TO ALL KINDS OF MINES, DRAINAGE, WELLS, MARINE, FIRE, &c.

J. U. ASTIER begs to call the attention of proprietors of mines, engineers, architects and the public in general, to his new pump, the cheapest and most efficient ever introduced to public notice. The principle of this new pump is simple and effective, and its action is so arranged that accidental breakage is impossible. It occupies less space than any other kind of pump in use, does not interfere with the working of the shafts, and unites lightness with a degree of durability almost imperishable. By means of this hydraulic machine water can be raised economically from wells of any depth; it can be worked either by steam-engine or any other motive power, by quick or slow motion. The following statement presents some of the results obtained by this hydraulic machine, as daily demonstrated by use:—

1.—It utilises from 90 to 92 per cent. of the motive power.

2.—Its price and expense of installation is 75 per cent. less than the usual pump employed for mining purposes.

3.—It occupies a very small space.

4.—It raises water from any depth with the same facility and economy.

5.—It raises with the water, and without the slightest injury to the apparatus, sand, mud, wood, stone, and every object of a smaller diameter than its tube.

6.—It is easily removed, and requires no cleaning or attention.

J. U. ASTIER, sole manufacturer, will CONTRACT TO ERECT HIS PATENT PUMP AT HIS OWN EXPENSE, and will GUARANTEE IT FOR ONE YEAR, or will GRANT LICENSE to manufacturers, mining proprietors, and others, for the USE of his INVENTION.

OFFICES, 47, WARREN STREET, FITZROY SQUARE.

London, March 21, 1859. Hours from Ten till Four. J. U. ASTIER C.E.

THE MECHANICS' MAGAZINE, AND JOURNAL OF THE APPLIED SCIENCES.—Established 40 years.

The Mechanics' Magazine has from its establishment had an extensive circulation, and it communicates, for 4d. per week, far more valuable information, both scientific and practical, than was ever before placed within the reach of even those who could afford to pay six times as much for it.—Lord Brougham.

Published weekly, price 4d., by post 5d. London: 166, Fleet-street, E.C.

T H E B U I L D I N G N E W S.—An Illustrated Journal, price 4d., devoted to Architecture, Civil Engineering, the Arts of Design and Building. It contains original and practical Essays on Fine Art and on the Principles and Practices of Construction, Notices of New Buildings in all parts of the kingdom, Reports of Architectural and Scientific Societies, Notes on Church Decorations, Memorials and Stained Glass; Sanitary, Gas, Water, and other Intelligences; Improved Dwellings for the Working Classes; Lists of Tenders received, and of Competitions and Contracts open; suggestions (sometimes illustrated) on subjects specially interesting to Architects, Builders, Contractors, and their Employes; correct weekly lists of all new patented inventions connected with every branch of the building trade, and a variety of interesting miscellaneous matter.

London: 166, Fleet-street, E.C.

T H E N E W C A S T L E C H R O N I C L E A N D N O R T H E R N C O U N T I E S ADVERTISER. (ESTABLISHED 1764).

Published every Saturday, price 2d., or quarterly 2s. 2d.

THE DAILY CHRONICLE AND NORTHERN COUNTIES ADVERTISER.

Published every morning, price 1d.

Offices, 43, Grey-street, Newcastle-upon-Tyne; 50, Howard-street, North Shields; 195, High-street, Sunderland.

International Exhibition, 1862—Prize Medal.

JAMES RUSSELL AND SONS (the original patentees and first makers of wrought-iron tubes), of the CROWN PATENT TUBE WORKS, WEDNESBURY, STAFFORDSHIRE, have been AWARDED a PRIZE MEDAL for the "good work" displayed in their wrought-iron tubes and fittings. Warehouse, 81, Upper Ground-street, London, S.

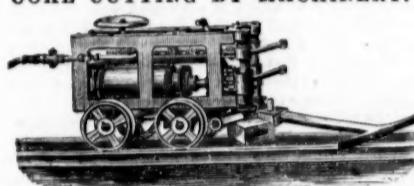
Prize Medals—International Exhibition, Class 1 and 2.

PATENT PLUMBAGO CRUCIBLES.—The CRUCIBLES manufactured by the PATENT PLUMBAGO CRUCIBLE COMPANY are the ONLY KIND for which a MEDAL has been AWARDED, and are now used exclusively by the English, Australian, and Indian Mints; the French, Russian, and other Continental Mints; the Royal Arsenals of Woolwich, Brest, and Toulon, &c., and have been adopted by most of the large ENGINEERS, BRASSFOUNDERS, and REFINERS in this country and abroad. The GREAT SUPERIORITY of these melting pots consists in their capability of melting an average 40 pounds of the most difficult metals, and a still greater number of those of an ordinary character, some of them having actually reached the EXTRAORDINARY NUMBER of 96 melting. They are unaffected by change of temperature, never crack, and become heated much more rapidly than any other crucible. In consequence of their great durability, the saving of waste is also very considerable.

For lists, testimonials, &c., apply to the Patent Plumbago Crucible Company, Battersea Works, London, S.W.

Fully described in the MINING JOURNAL of July 5.

COAL CUTTING BY MACHINERY.



M E S S R S. R I D L E Y A N D C O. have, by recently PATENTED IMPROVEMENTS, COMPLETED their TRUNK COAL CUTTING MACHINE, WORKED by COMPRESSED AIR, and are NOW PREPARED to NEGOTIATE for the USE, and to SUPPLY MACHINES, which will be found to COMBINE SIMPLICITY OF CONSTRUCTION WITH PORTABILITY and ECONOMY in WORKING. By the use of these machines a CONSIDERABLE SAVING of COAL is EFFECTED, and the COST of LABOUR MUCH REDUCED. Each machine will be guaranteed as to its capabilities, &c.

All applications to be made to Messrs. RIDLEY and Co., No. 11, South-street, Finsbury London, E.C.; or Mr. PIERCY BARKER, agent, 9, Clement's-lane, E.C.

* * * COLLIER PROPRIETORS are CAUTIONED against PURCHASING or USING MACHINES, the construction of which will constitute an INFRINGEMENT of the ABOVE PATENT.

T H O M A S T U R T O N A N D S O N S. MANUFACTURERS OF

CAST STEEL for PUNCHES, TAPS, and DIES, TURNING TOOLS, CHISELS, &c.

CAST STEEL PISTON RODS, CRANE PINS, CONNECTING RODS, STRAIGHT and CRANK AXLES,

SHAFTS, and

FORGINGS of EVERY DESCRIPTION.

DOUBLE SHEAR STEEL, FILES MARKED T. T U R T O N . SPRING STEEL, EDGE TOOLS MARKED WM. GREAVES & SON GERMAN STEEL. Locomotive Engine, Railways Carriage and Wagon Springs and Buffers.

SHEAF WORKS AND SPRING WORKS, SHEFFIELD. LONDON WAREHOUSE, 35, QUEEN STREET, CANNON STREET, CITY, E.C. where the largest stock in the world may be selected from.

M E S S R S. W. E A S S I E A N D C O., RAILWAY SAW MILLS, MOULDING SHOPS, &c., AND GENERAL TIMBER CONVERTING YARDS, HIGH ORCHARD, GLOUCESTER,

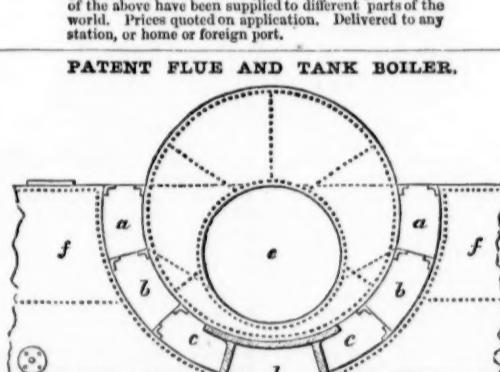
ARE PREPARED to FURNISH QUOTATIONS for any description of WOOD FITTINGS for home or foreign RAILWAY STATIONS, BARRACKS, EXHIBITIONS, DWELLINGS, WAREHOUSES, FACTORIES, STORES, GLASS HOUSES, &c.

They will also CONTRACT for WOODEN FITTINGS of ANY KIND in CONNECTION with IRON BUILDINGS, &c.

The above will in all cases be consigned ready fitted, so as to ensure speedy re-erection.

Numerous drawings of works of the above nature, already executed, can be seen on application, and references permitted to the engineers thereof.

PATENT FLUE AND TANK BOILER.



J E W E L L ' S PATENT FLUE AND TANK BOILER. A PLAN FOR ECONOMISING THE CONSUMPTION OF FUEL IN STEAM BOILERS.

The advantages of this boiler, an illustrated description of which was published in the MINING JOURNAL of October 3, are obvious.

It is provided with WROUGHT IRON FLUES, conveying the fire entirely over the surface of boiler below the water line, and wholly doing away with flues coming in contact with any part of the boiler, lime having been found to destroy the boiler plates before any other part of the boiler is affected.

This boiler has four additional flues to the plan at present adopted, thus affording a FAN GREATER AMOUNT of HEATING SURFACE, and MORE EFFECTUALLY CONSUMING the GASES. Between the boilers a wrought-iron tank is fixed, extending the whole length of the boilers, for containing water for feed; this water will pass into the boiler at any temperature required. This boiler will not require anyone to enter the flues for cleaning, as the flues are provided with shifting stoves at the ends, enabling a person to cleanse the flues even while the boiler is hot; this plan answers for any size or length boiler, and will do away with the cold feed water.

On the top of the tank a pipe will be placed, to take the waste steam that occurs, and carry it to the cistern. The flues for a 6 ft. boiler will be 2 ft. long, and the usual width. It must be remembered that the tank once hot will remain a hot body, with the same amount of heat that passed off before the brick walls.

I would observe that there will be no more water taken from these tanks than will be required for the feed, consequently no more water will pass into these tanks than will be necessary for feeding. It is believed this plan will SAVE TEN FEET in the LENGTH of BOILER, and it has been proved to EFFECT a SAVING of rather MORE than ONE-THIRD in the CONSUMPTION OF FUEL. These boilers, with flues and tanks, can be supplied on the most reasonable terms.

NOTE.—This plan of Flues and Tank Boiler will be found very beneficial for MARINE ENGINES; the tank would receive the water from the sea, and would not only become hot for feed, but would be the means of preventing in a great measure the salt from passing into the boiler. Where great quantities of hot water are required for other purposes, these tanks will also be found very beneficial.

JOHN JEWELL.

BOSTON, September 30, 1863.

* * * Mr. JEWELL is PREPARED to GRANT the ROYALTY to any parties, for certain districts of the United Kingdom.

C L I N T O N A N D O W E N S (L A T E B. F O W L E R A N D C O.), W H I T E F I A R S S T R E E T, F L E E T S T R E E T, L O N D O N, E.C. H Y D R A U L I C A N D G E N E R A L E N G I N E E R S, M